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EXAMINER
BARON, HENRY

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 May 2008*.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-94* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12,14-24,26-35, 37-46, 48-59, 61-71,73 -82, 84-93* is/are rejected.

7)☒ Claim(s) *13,25,36,47,60,72,83, and 94* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

        1.☐ Certified copies of the priority documents have been received.

        2.☐ Certified copies of the priority documents have been received in Application No. _____.

        3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

Detailed Action

Response to Arguments/Remarks

1.   Claims 1 – 94 are pending in action, with claims 1, 14, 25, 26, 37, 48, 61, 72, 73, and 84

amended.

2.   Examiner notes that drawing sheets for Figs. 1- 7D filed on January 28, 2004, are acceptable.

3.   Applicant's arguments filed 5/19/2008 have been fully considered but they are not fully

persuasive.

4.   Applicant, as a clarification amended claim 1 to recite applying the plurality of mapping

permutations in an alternating manner for a plurality of data tones which recites features not taught by

Kadous, who does not disclose applying a plurality of mapping permutations, let alone, applying the

plurality of mapping permutations in an alternating manner for a plurality of data tones. Rather, Kadous

discloses determining "data rates for a number of data streams transmitted via a number of transmission

channels in a multi-channel communication system."

5.   Examiner replies that Kadous teaches of receiving a selected spatial multiplexing rate

corresponding to at least one mapping permutation of symbols to a combination of tones (or sub-bands)

and antennas. Wu teaches of a plurality of mapping permutations in an alternating manner in teaching that

OFDM systems were designed conventionally for either time diversity, one permutation, or for space

diversity, a second permutation. Once data symbols are mapped to a set of antennas and tones in a time or

space diversity permutation, the pattern is repeated in an alternating manner (see, for example, Wu

Figure 2).

6.   Applicant argues with respect to claim 8 as reciting that the mapping permutations are applied to

the plurality of data tones in a cyclical manner and in the statement of rejection, the Examiner asserted

that Rietz discloses that the nature of the permutation mapping of the permutation of Rietz is cyclical.

7.   Applicants maintain the argument that Rietz only discloses the algebraic definition of

combinations of all things different. Combinations do not teach or suggest applying permutations in a

cyclical order. Rather, combinations ignore order. Rietz does not disclose applying mapping permutations

in a cyclical manner.

8.   Applicant argues that Kadous teaches of an MIMO-OFDM system where channels are formed

through a combination of antennas and tones. (3: [0036] read MIMO system employs multiple (N.sub.T)

transmit antennas and multiple (N.sub.R) receive antennas for data transmission. A MIMO channel

formed by the N.sub.T transmit and N.sub.R receive antennas may be decomposed into N.sub.S

independent channels, with N.sub.S.ltoreq.min[N.sub.T,N.sub.R]. Each of the N.sub.S independent

channels may also be referred to as a spatial subchannel (or transmission channel) of the MIMO-OFDM

channel.). Wu teaches of at least two permutations i.e. space time transmitter diversity (STTD) and

spatial multiplexing (SM). Further, in Wu teaches in Figure 3 of mapping these permutations cyclically

across a set of tones (frequency) and antennas. Rietz teaches of an algebraic definition of combinations of

a subset of all things different when applied to a set of antenna and tones, where Wu's STTD and SM are

of two instances. Examiner argues that it would be obvious, as a function channel conditions (also taught

by Wu, Abstract), to apply combinations of Rietz in a cyclical manner, as taught by Wu, for permutations

between STTD and SM in order to optimize these resources.

Claim Rejections - 35 USC § 103

9.   The following s a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness

rejections set forth in this Office action:

> a.   A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that
> the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary
> skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the
> invention was made

10.   Claims 1 – 4, 14 –17, 26 – 28, 37 – 40, 48 – 51, 61 –64, 73 –75, and 84 –87 are rejected under 35 U.S.C. 102(e) as being unpatentable over Kadous et al (U.S. Patent 6,636,568) in view of Wu (U.S. Patent Application 20020122383)

11.   Regarding Claim 1, 26, 48, and 73, Kadous teaches computer-readable medium, method and apparatus for receiving a selected spatial multiplexing rate, the spatial multiplexing rate corresponding to the a mapping permutation; (Figure 5, read rate control), and for each of a plurality of data tones (Figure 5 read encoders block 512a), mapping the plurality of data symbols (Figure 5, block 516a) to a plurality of antennas (Figure 5 block 124a-t) using a corresponding one of the one mapping permutations. (16:[0010-0051])

12.   Kadous does not disclose a plurality of data tones, applying the plurality of mapping permutations in an alternating manner to map one or more of a plurality of data symbols to a plurality of antennas.

13.   Wu teaches of a plurality of data tones, applying the plurality of mapping permutations in an alternating manner to map one or more of a plurality of data symbols to a plurality of antennas. (1: [0015] read .. multiple inputs, multiple output (MIMO) structure has multiple communication channels that are used between transmitters and receivers. A space time transmitter diversity (STTD) system may be used on a MIMO structure i.e. applying the plurality of mapping permutations in an alternating manner, but it will not increase the data throughput. Indeed, for a high level configuration, the data rate may even reduce. In an STTD system, the transmitters deliver the same information content within consecutive symbol i.e. data symbols, duration so that time diversity may be exploited. To efficiently use the multiple transmitters i.e. plurality of antennas, of the MIMO structure, however, the transmission data rate needs to be increased. And 1: [0009] read Orthogonal frequency-domain multiplexing (OFDM) systems were designed conventionally for either time diversity or for space diversity, but not both i.e. applying the plurality of mapping permutations i.e. time diversity or for space diversity, to map one or more of a plurality of data symbols to a plurality of antennas.)

14.   Wu also teaches of applying the plurality of mapping permutations in an alternating manner to map one or more of a plurality of data symbols to a plurality of tones. (1: [0014] read .. OFDM system, there are many OFDM modes, for examples are the 1 k mode (1024 tones) and the half k mode(5 12 tones). For 1 k mode, the number of sub-carriers is 1024 and for the half k mode, the number of sub-carriers is 512. The 1 k mode is suitable for a channel with long delay and slow temporal fading, while the 512 mode is suitable for the channel with a short delay and fast temporal fading)

15.   It would have been obvious at the time the invention was made by a person of ordinary skill in the art to modify the teachings of Kadous with Wu.

16.   In this manner, by comparing the channel condition of each sub-carrier with a threshold one of a plurality of mapping permutations i.e. space time transmitter diversity (STTD) or spatial multiplexing (SM), can be employed to optimally utilize antenna and sub-channel resources.

17.   Considering Claims 2 – 4, 27 – 28, 49 –51, and 74 –75, Kadous teaches that plurality of data tones comprise data tones in an OFDM symbol, mapping comprises space frequency coding the OFDM symbol (16:[0052-0055]), and transmitting the coded OFDM symbol on the plurality of antennas (16: [0067]).

18.   Regarding Claims 14, 37, 61, and 84, Kadous teaches a method and apparatus for receiving space frequency coded symbol from a plurality of antennas (Figure 6, block 152a-r), with a selected spatial multiplexing rate, the spatial multiplexing rate corresponding to one or more mapping permutations; (Figure 5, read rate control), and for each of a plurality of data tones (Figure 5 read encoders block 512a), mapping one or more data symbols (Figure 5, block 516a) to a plurality of antennas (Figure 5 block 124a-t) using a corresponding one of the one or more mapping permutations. (16:[0010-0051]).

19.   Considering Claims 17, 40, 64, and 87, Kadous teaches the space frequency coded symbol comprises a space frequency coded OFDM symbol. (16:[0052-0055]).

20.   With regards to Claims 15 – 16, 38 – 39, 62 – 63, and 85 – 86, Kadous teaches of linear decoding

(19:[0028-0035) and nonlinear decoding (19: [0037-0049).

21.   Claims 5 – 12, 18 – 24, 29 – 35, 41 – 46, 52 – 59, 65 – 71, 76 – 82, and 88 – 93 are rejected

under 35 U.S.C. 103(a) as being unpatentable over Kadous et al (U.S. Patent 6,636,568) in view of Wu

(U.S. Patent Application 20020122383), in view of Gesbert, et al. From Theory to Practice: An Overview

of MIMO Space–Time Coded Wireless Systems, IEEE JOURNAL ON SELECTED AREAS IN

COMMUNICATIONS, VOL. 21, NO. 3, APRIL 2003, and in further view of Rietz, College Algebra

pages 186 – 187, Henry Holt and Company, 1909.

22.   Regarding Claims 5, 29, 52, and 76, Kadous teaches a method and apparatus comprised of

receiving a selected spatial multiplexing rate (2: [0025-0030] read data rates) for each of a plurality of

data tones (3: [0030-0035] i.e. MIMO-OFDM) mapping one or more of a plurality of data symbols to a

plurality of antennas (3: [0035 -0040] Nt transmit antennas). In Figure 1, Kadous teaches of

demultiplexing (data source 112 to TX/RX 124i)

23.   However, Kadous is silent in disclosing of a spatial multiplexing rate corresponding to the

mapping permutations of $M_t!/(M!x(Mr-M)!)$ where M is the spatial multiplexing rate and M_t is the

number of antennas.

24.   Rietz teaches of plurality of mapping permutations comprise $M_t!/(M!x(Mr-M)!)$ permutations,

(page 186, Section 134; Combination of things all different) and Gesbert teaches that M is (the range) of

spatial multiplexing rates e.g. from maximum diversity to maximum multiplexing and M_t is the number of

antennas(page 287; Section IV Transmission over MIMO; General Principles; paragraph 1 – read and

unification of categories).

25.   It would have been obvious at the time the invention was made to a person having ordinary skill

in the art to which said subject matter pertains to modify the *selected* spatial multiplexing rate teachings

of Kadous to the range of multiplexing rate teachings of Gesbert using the permutation teachings of Rietz.

26.   The modification would yield an improvement in transmission efficiency because the *selected* spatial multiplexing rate can be chosen to match channel conditions over any value within a range spatial multiplexing rates thereby optimizing the transmission system.

27.   With respect to claims 6 – 7, 30, 53 – 54, and 77 Gesbert teaches of a range of spatial multiplexing rates e.g. from maximum or pure diversity to maximum or pure multiplexing (page 287; Section IV Transmission over MIMO; General Principles; paragraph 1 – read and unification of categories) selected from a plurality of available spatial multiplexing rates corresponding to the number of antennas.

28.   Considering Claims 8, 31, 55, and 78, the nature of permutation mapping of the permutation (sic combination) of Rietz (page 186, Section 134; Combination of things all different) is cyclical.

29.   With regards to Claims 9, 32, 56, and 79, Gesbert teaches of mapping with an apparatus compliant with a standard selected from the group consisting of IEEE standards 802.16. (Page 297 Section; Standardized Models).

30.   Considering Claims 10, 33, 57, and 80 Gesbert teaches of a range of spatial multiplexing rates e.g. from maximum spatial diversity to maximum multiplexing (page 287; Section IV Transmission over MIMO; General Principles; paragraph 1 – read and unification of categories).

31.   With respect to Claims 11, 34, 58, and 81, Gesbert teaches of transmitting the data symbols from the antennas at a substantially equal power. (Page 284 equation 4 and equal power in subsequent paragraph).

32.   Considering Claims 12, 35, 59, and 82, Gesbert teaches of mapping data symbols to antennas for each of data tones using less than the available tone-antenna combinations. (Page 287; Section IV Transmission over MIMO; General Principles; paragraph 1 – read diversity maximization).

33.   Regarding Claims 18, 41, 65, and 88, Kadous teaches of a method and apparatus comprised of receiving a space frequency coded symbol from antennas, the space frequency coded symbol including

data tones, (4: [0031-0045] read RX MIMO) for each of a plurality of data tones (3: [0030-0035] i.e.

MIMO-OFDM) mapping one or more of a plurality of data symbols to a plurality of antennas (4: [0031 -

0045]).

34.   However, Kadous is silent in teaching of a spatial multiplexing rate corresponding to the mapping

permutations of $M_t !/(M!x(Mr-M)!)$ where M is the spatial multiplexing rate and M_t is the number of

antennas.

35.   Gesbert teaches of a range of spatial multiplexing rates e.g. from maximum diversity to maximum

multiplexing (page 287; Section IV Transmission over MIMO; General Principles; paragraph 1 – read and

unification of categories).

36.   Rietz teaches of one or more mapping permutations. (Page 186, Section 134; Combination of

things all different).

37.   It would have been obvious at the time the invention was made to a person having ordinary skill

in the art to which said subject matter pertains to modify the received spatial multiplexing rate teachings

of Kadous to the *range* of multiplexing rate teachings of Gesbert using the permutation teachings of

Rietz.

38.   The modification would yield an improvement in reception efficiency because the received

spatial multiplexing rate can be chosen to match channel conditions over any value within a range spatial

multiplexing rates thereby optimizing the receiving system.

39.   With respect to Claims 19 – 20, 42 – 43, 66 – 67, and 89 – 90, Gesbert teaches of a range of

spatial multiplexing rates e.g. from maximum or pure diversity to maximum or pure multiplexing (page

287; Section IV Transmission over MIMO; General Principles; paragraph 1 – read and unification of

categories) selected from a plurality of available spatial multiplexing rates corresponding to the number of

antennas.

40.   Considering Claims 21, 44, 68, and 91, the nature of permutation mapping of the permutation (sic combination) of Rietz (page 186, Section 134; Combination of things all different) is cyclical.

41.   With regards to Claims 22, 45, 69, and 92, Gesbert teaches of mapping with an apparatus compliant with a standard selected from the group consisting of IEEE standards 802.16. (page 297 Section; Standardized Models).

42.   With respect to Claims 23, and 70, Gesbert teaches of a range of spatial multiplexing rates e.g. from maximum spatial diversity to maximum multiplexing (page 287; Section IV Transmission over MIMO; General Principles; paragraph 1 – read and unification of categories).

43.   In regards to Claims 24 and 71, Gesbert teaches of receiving the data symbols from the antennas at a substantially equal power. (Page 284 equation 4 and equal power in subsequent paragraph).

44.   Considering Claims 46 and 93, Gesbert teaches of mapping data symbols to antennas for each of data tones using less than the available tone-antenna combinations. (Page 287; Section IV Transmission over MIMO; General Principles; paragraph 1 – read diversity maximization).

Allowable Subject Matter

45.   Claims 13, 25, 36, 47, 60, 72, 83 and 94 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. What is distinguishing of these claims is the citation '.. mapping permutation to the plurality of antennas for a plurality of *adjacent* (Examiner's italics) tones.' In this case, a super-set of a permutation is used to mitigate inter-channel interference, which is a feature that is not taught by the prior art.

Conclusion

46.   Any inquiry concerning this communication or earlier communications from the examiner should be directed to HENRY BARON whose telephone number is (571)270-1748. The examiner can normally be reached on 7:30 AM to 5:00 PM E.S.T. Monday to Friday.

47.   If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor,

Seema Rao can be reached on (571) 272-3174. The fax phone number for the organization where this

application or proceeding is assigned is 571-273-8300.

48.   Information regarding the status of an application may be obtained from the Patent Application

Information Retrieval (PAIR) system. Status information for published applications may be obtained

from either Private PAIR or Public PAIR. Status information for unpublished applications is available

through Private PAIR only. For more information about the PAIR system, see http://pair-

direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer

Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR

CANADA) or 571-272-1000.

HB

/Brenda Pham/
Primary Examiner, Art Unit 2616